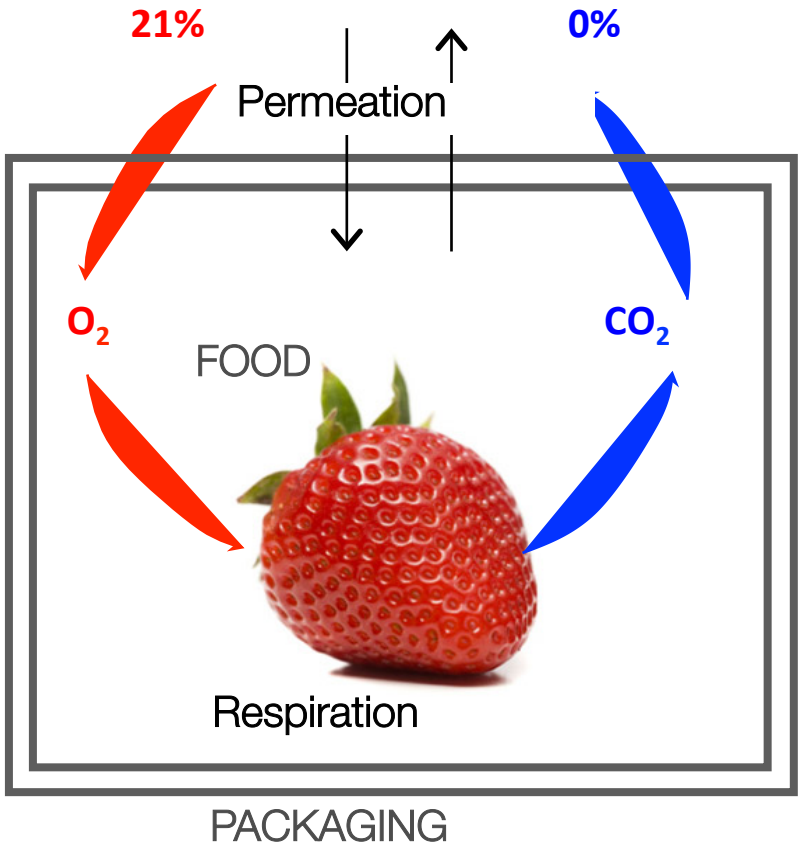
Modified Atmosphere Packaging for fresh produce

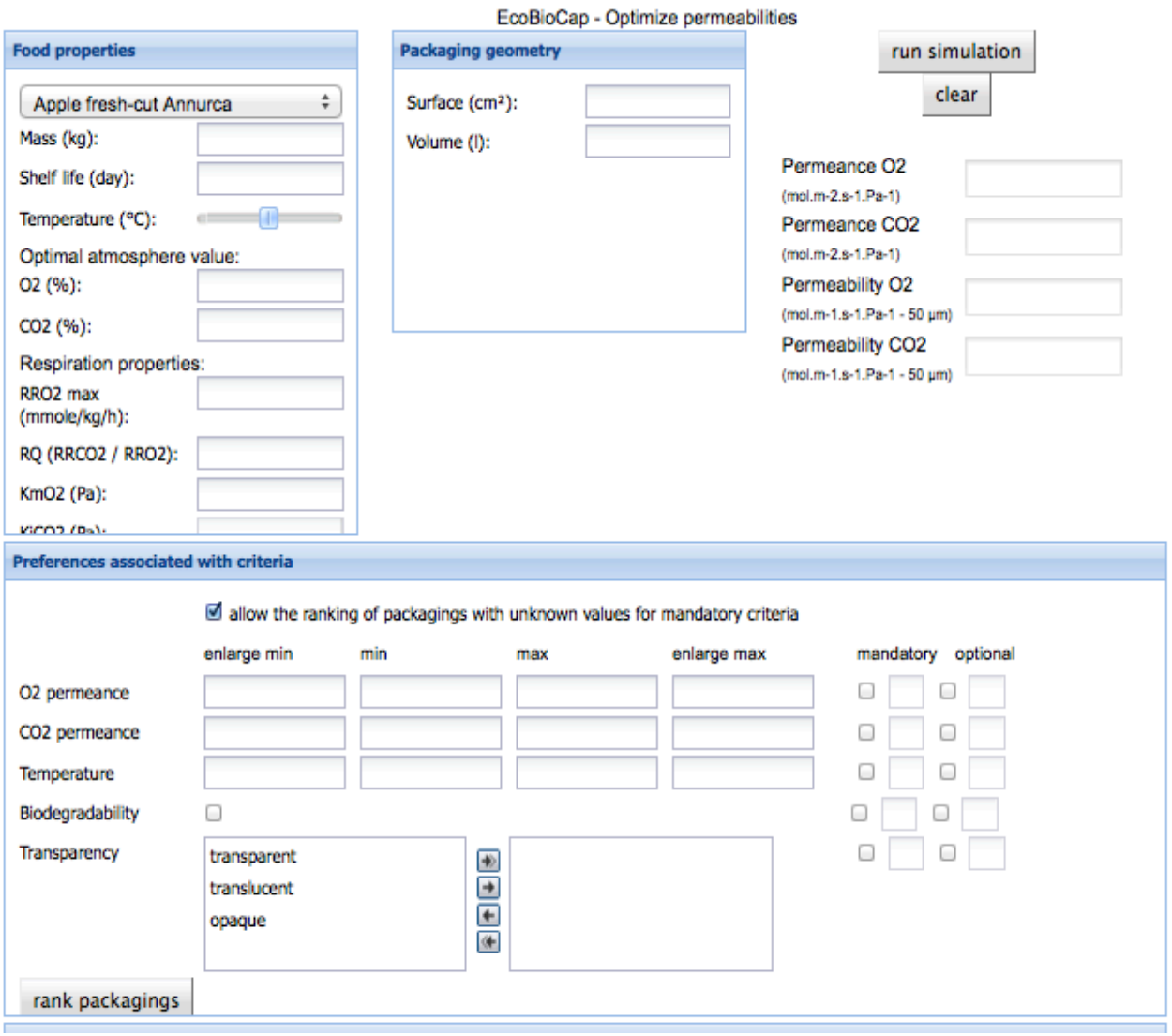


Valérie Guillard

UMR 1208 IATE (UM2, CIRAD, INRA, Montpellier SupAgro)
F-34095 Montpellier

guillard@univ-montp2.fr

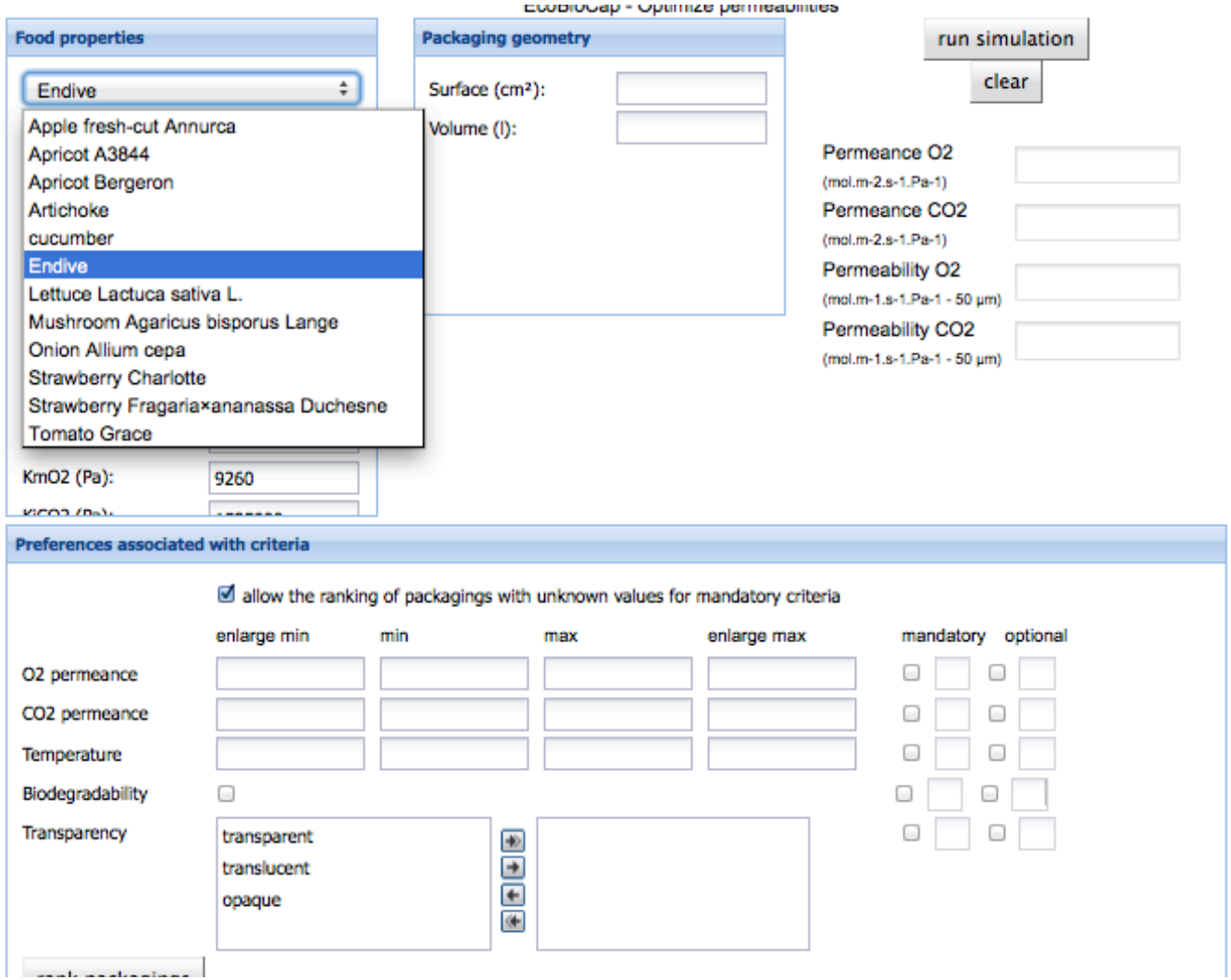
ECOBIOCAP A Decision Support System ...



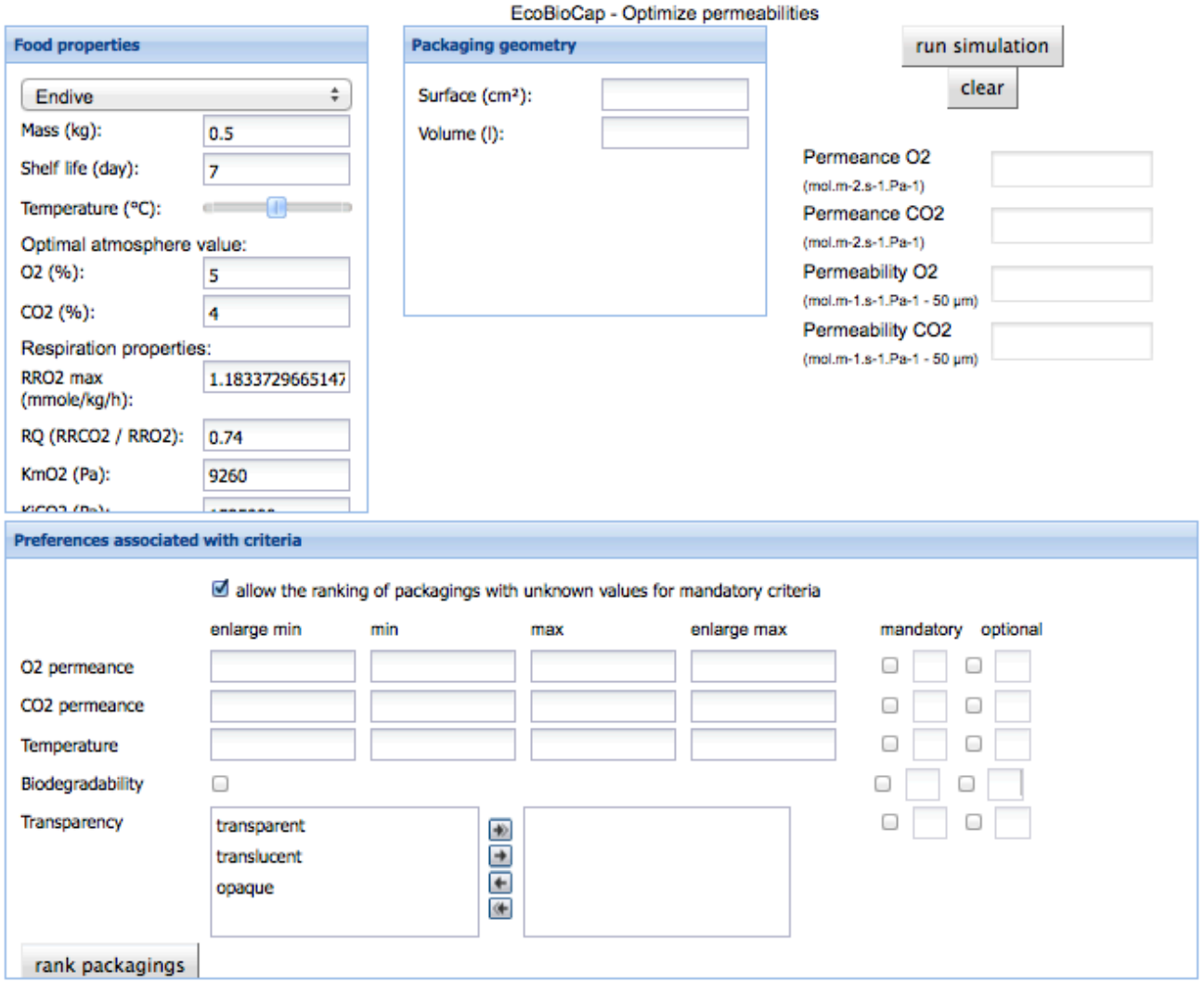
SEVENTH FRAMEWORK PROGRAMME

ECOBIOCAP A Decision Support System ...

Chose of a fresh produce among a list of possibilities



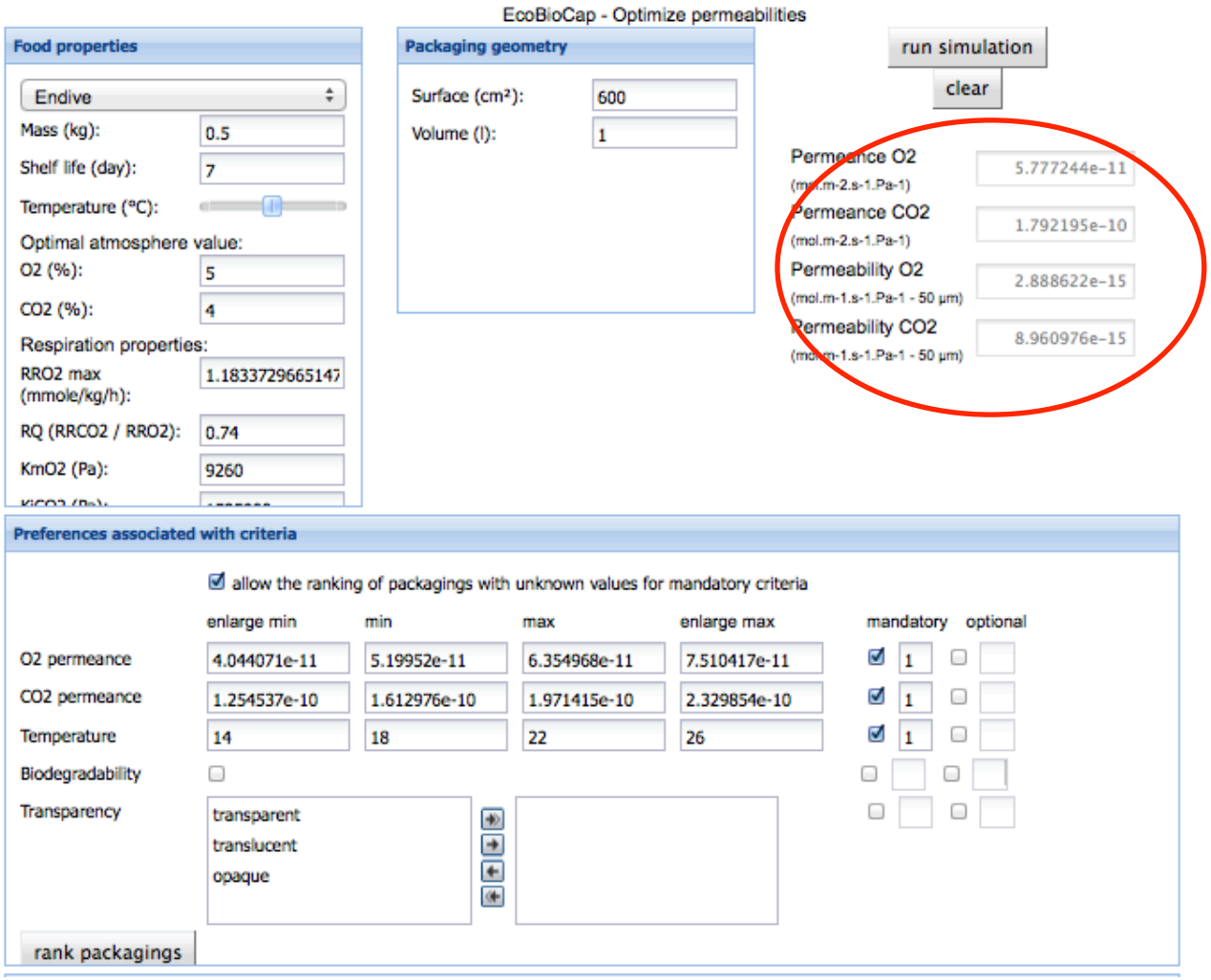
ECOBIOCAP A Decision Support System ...



SEVENTH FRAMEWORK PROGRAMME

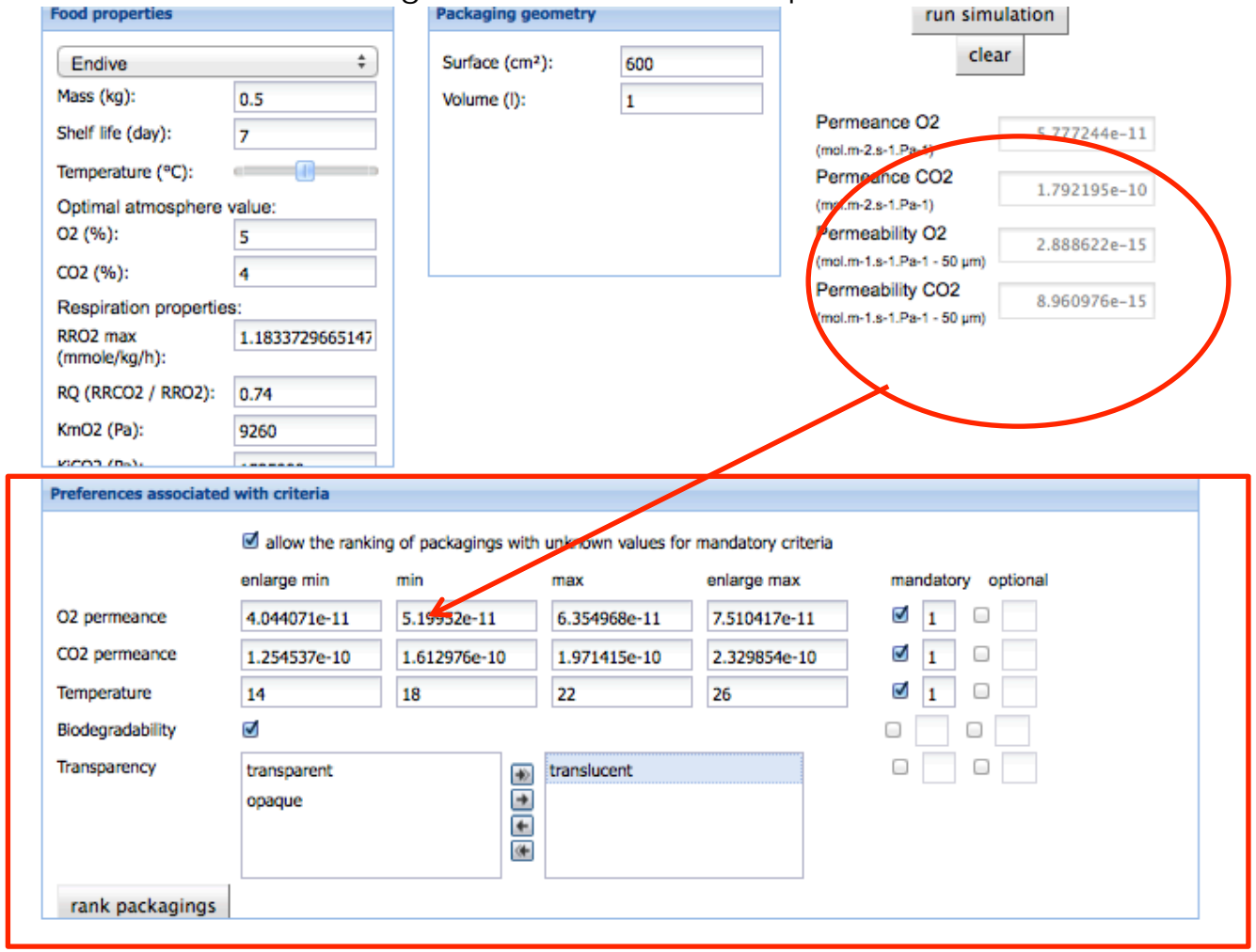
ECOBIOCAP A Decision Support System ...

Fill in the data required for packaging geometry then run the simulation



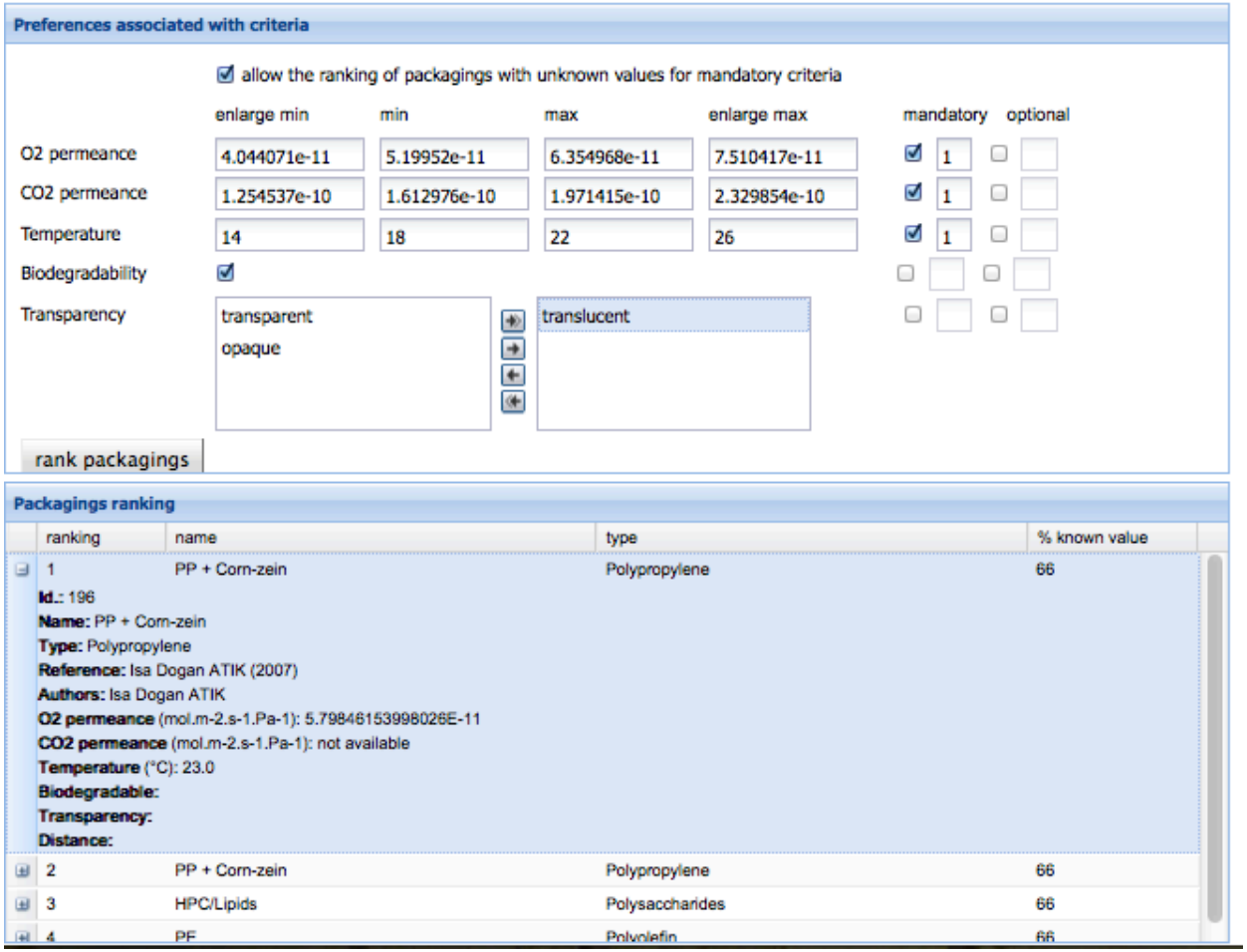
ECOBIOCAP A Decision Support System …

Building of the multi-criteria request …



ECOBIOCAP A Decision Support System ...

Ranking of the most suitable materials



Importance of input parameters and databases

Oxygen and Carbon Dioxide Permeability of Wheat Gluten Film: Effect of Relative Humidity and Temperature

H. Mujica-Paz and N. Gontard*

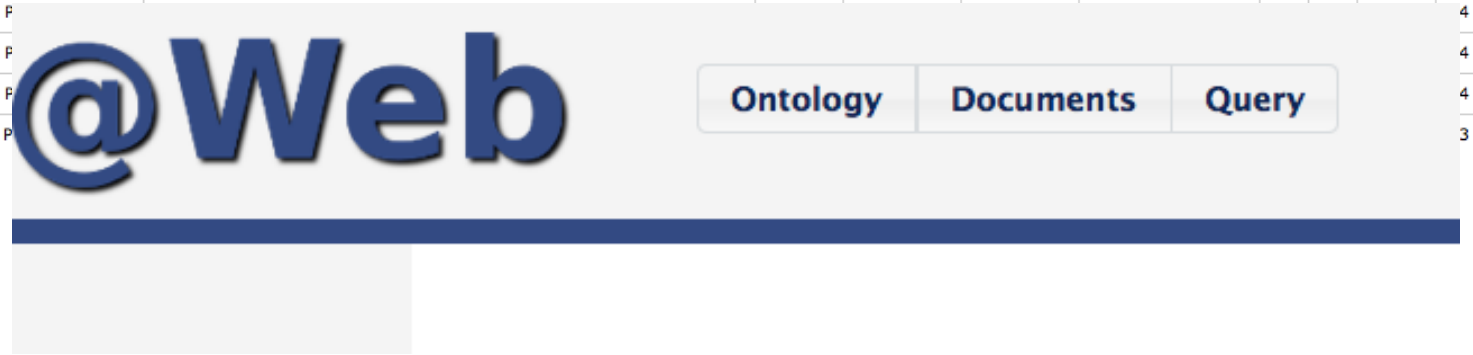
ENSIA/CIRAD, B.P. 5098, 1101 avenue Agropolis, 34033 Montpellier Cedex 01, France

Table 2. Central Composite Design Arrangement and Responses

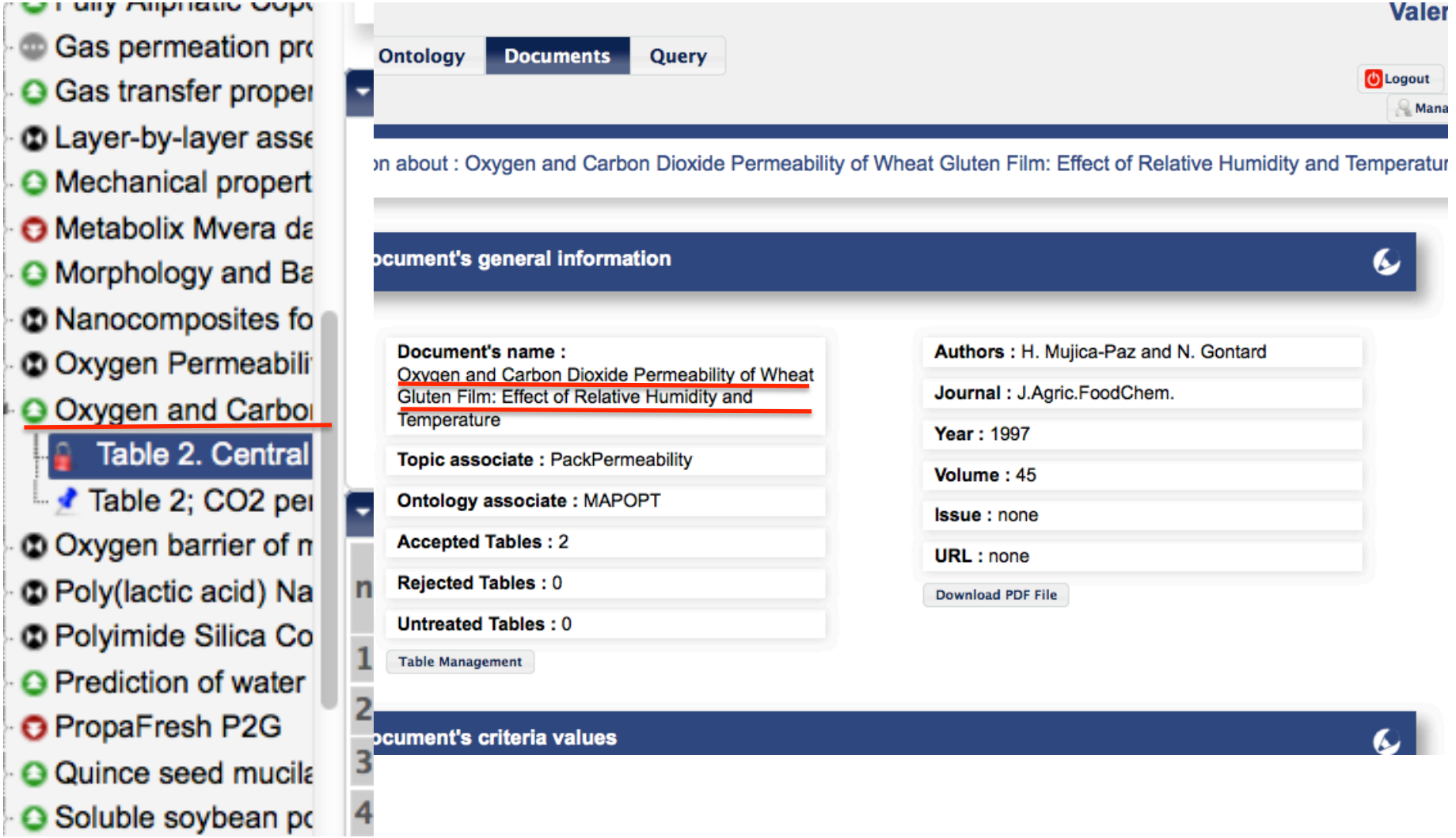
variable levels		responses		
T (°C)	RH (%)	CO_2 permeability (amol s^{-1} m^{-1} Pa^{-1})	O_2 permeability (amol s^{-1} m^{-1} Pa^{-1})	select-ivity
9	14.6	258	111	2.3
39	14.6	314	131	2.4
9	85.3	11475	1011	11.3
39	85.3	22353	863	25.9
3	50	317	181	1.7
45	50	1026	233	4.4
24	0	88	77	1.1
24	100	55580	1970	28.2
24	50	536	159	3.3
24	50	545	152	3.5

Importance of input parameters and databases

A	E	F	G	H	I	J	K	L	M	N	O	P
REFERENCE	**COMMERCIAL NAME or NAME**	**MATERIAL TYPE**	**Application**	**O2 permeability**		**O2 perm unit**	**O2 perm RH**		**RH unit**	**O2 perm Temperature**		**Temperature unit**
				min	**max**		**min**	**max**		**min**	**max**	
BASF The Chemical Company	Ecoflex FBX 7011	Aliphatic-aromatic copolyester based on the monomers 1, 4 butanediol, adipic acid, terephthalic acid for film extrusion		1400	1400	cm3/(m2.d.bar)	0	0	%	23	23	°C
BASF The Chemical Company	Ecovio LBX 8180	Product containing renewable resources, is basically a compound of our boidegradable copolyester Ecoflex FBX 7011 and polylactic acid (PLA)		30	30	cm3/(m2.d.bar)	0	0	%	23	23	°C
Sanchez-Garcia et al 2008	PHB blend	PHB/PCL, 80:20 wt/wt		4.1995E-19	4.2005E-19	m3.m/(m2.s.Pa)	0	0	%	24	24	°C
Sanchez-Garcia et al 2008	PHB blend	PHB/PCL, 80:20 wt/wt		5.196E-19	5.204E-19	m3.m/(m2.s.Pa)	80	80	%	24	24	°C
Sanchez-Garcia et al 2008	NanoterPHB-Blend	1% of wt (Nanoter ™ 2212) based on Kaolinite in PHB blend (PHB/PCL, 80:20 wt/wt)		3.5E-19	4.1E-19	m3.m/(m2.s.Pa)	0	0	%	24	24	°C
Sanchez-Garcia et al 2008	NanoterPHB-Blend	1% of wt (Nanoter ™ 2212) based on Kaolinite in PHB blend (PHB/PCL, 80:20 wt/wt)		3.8E-19	4E-19	m3.m/(m2.s.Pa)	80	80	%	24	24	°C
Sanchez-Garcia et al 2008	NanoterPHB-Blend	4% of wt (Nanoter ™ 2212) based on Kaolinite in PHB blend (PHB/PCL, 80:20 wt/wt)		2.1E-19	2.7E-19	m3.m/(m2.s.Pa)	0	0	%	24	24	°C
Sanchez-Garcia et al 2008	NanoterPHB-Blend	4% of wt (Nanoter ™ 2212) based on Kaolinite in PHB blend (PHB/PCL, 80:20 wt/wt)		2.6E-19	3E-19	m3.m/(m2.s.Pa)	80	80	%	24	24	°C
Sanchez-Garcia et al 2008	PHB	Material with density 1,25 g/cm^3 is a metl-processable semicrystalline thermoplastic polymer made form renewable carbohydrate feedstocks		2.298E-19	2.302E-19	m3.m/(m2.s.Pa)	0	0	%	24	24	°C
Sanchez-Garcia et al 2008	NanoterPHB	4% of wt (Nanoter ™ 2212) based on Kaolinite in PHB		1.5E-19	2.1E-19	m3.m/(m2.s.Pa)	0	0	%	24	24	°C
Sanchez-Garcia et al 2008	P									4	24	°C
Sanchez-Garcia et al 2008	P									4	24	°C
Sanchez-Garcia et al 2008	P									4	24	°C
PropaFresh	P									3	23	°C



@Web - a software to capitalise data



CAPITALISATION

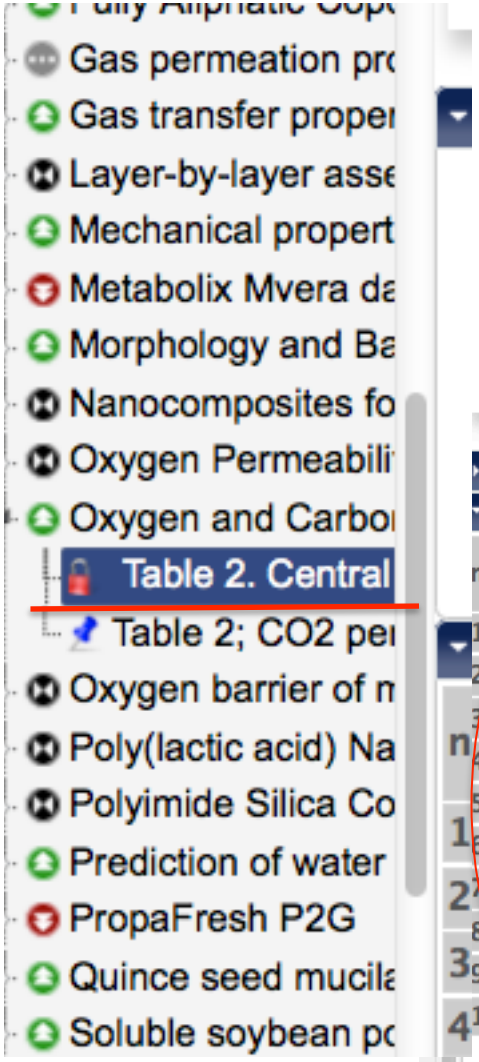


Table 2. Central Composite Design Arrangement and Responses

variable levels		responses		
T (°C)	RH (%)	CO_2 permeability (amol s^{-1} m^{-1} Pa^{-1})	O_2 permeability (amol s^{-1} m^{-1} Pa^{-1})	select-ivity
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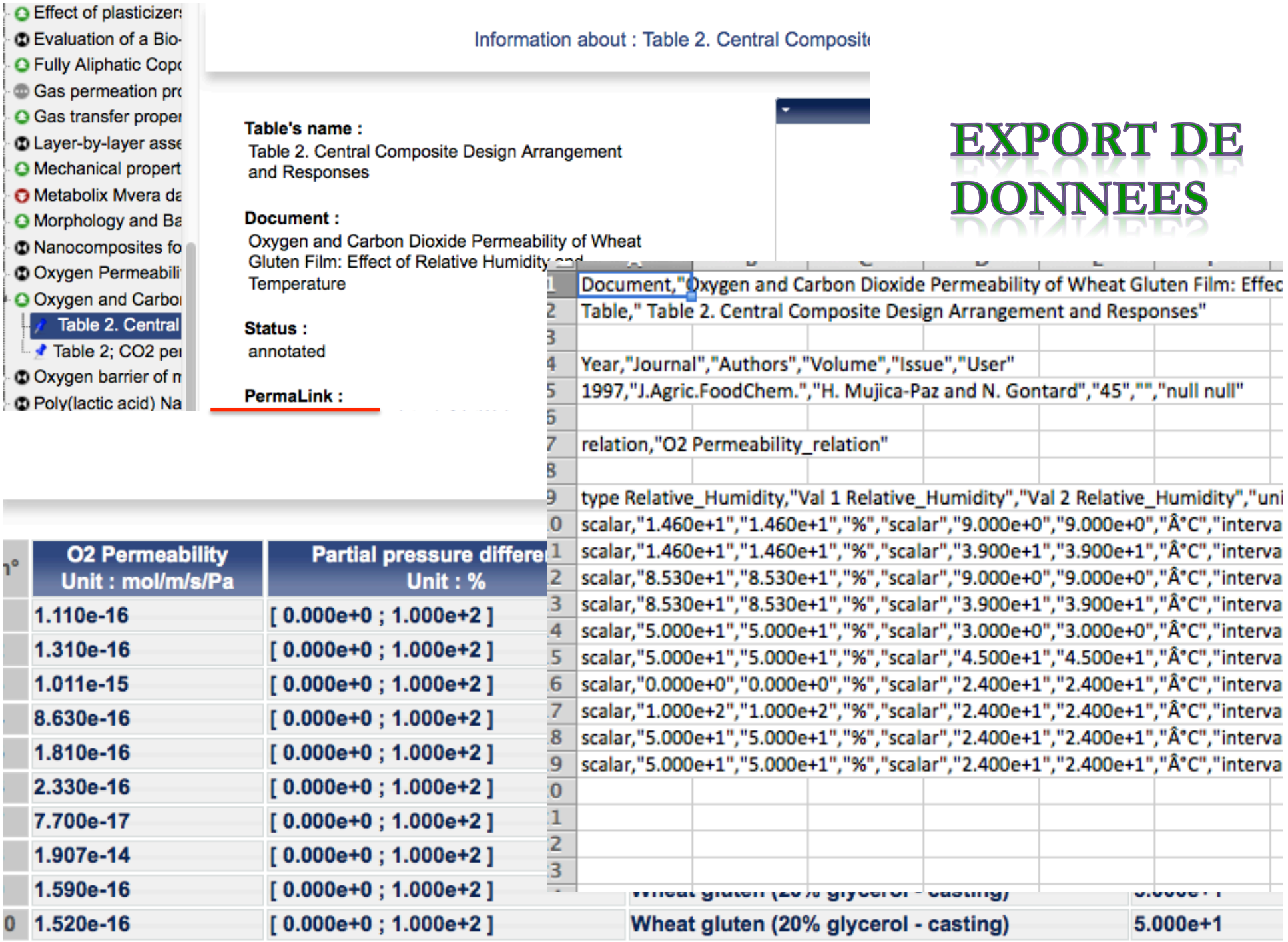
24	0	88	77	1.1
24	100	55580	1970	28.2
24	50	536	159	3.3
24	50	545	152	3.5

Original table

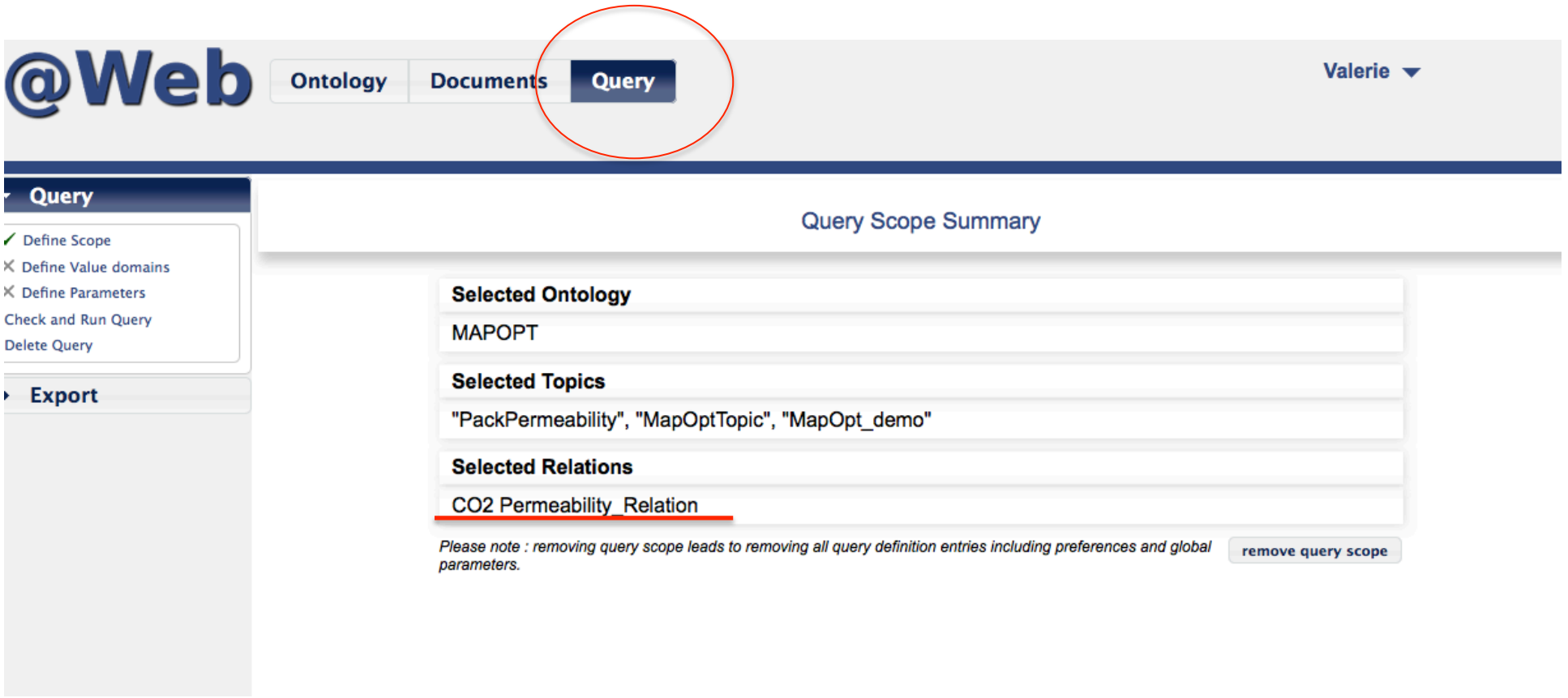
Annotated table

n°	O2 Permeability Unit : mol/m/s/Pa	Partial pressure difference Unit : %	Packaging	Relative_Humidity Unit : %	Temp Unit :
1	1.110e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	1.460e+1	9.000
2	1.310e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	1.460e+1	3.900
3	1.011e-15	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	8.530e+1	9.000
4	8.630e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	8.530e+1	3.900
5	1.810e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	5.000e+1	3.000
6	2.330e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	5.000e+1	4.500
7	7.700e-17	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	0.000e+0	2.400
8	1.907e-14	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	1.000e+2	2.400
9	1.590e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	5.000e+1	2.400
10	1.520e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	5.000e+1	2.400



n°	O2 Permeability Unit : mol/m/s/Pa	Partial pressure differe Unit : %		
	1.110e-16	[0.000e+0 ; 1.000e+2]		
	1.310e-16	[0.000e+0 ; 1.000e+2]		
	1.011e-15	[0.000e+0 ; 1.000e+2]		
	8.630e-16	[0.000e+0 ; 1.000e+2]		
	1.810e-16	[0.000e+0 ; 1.000e+2]		
	2.330e-16	[0.000e+0 ; 1.000e+2]		
	7.700e-17	[0.000e+0 ; 1.000e+2]		
	1.907e-14	[0.000e+0 ; 1.000e+2]		
	1.590e-16	[0.000e+0 ; 1.000e+2]		
0	1.520e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	5.000e+1

QUERY

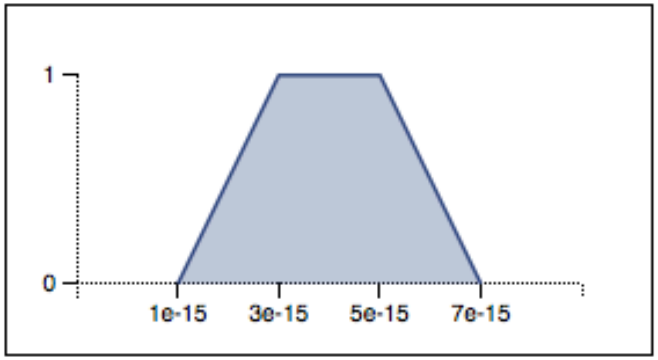

@Web
Ontology
Documents
Query
Valerie
Query
Define Scope
Define Value domains
Define Parameters
Check and Run Query
Delete Query
Export
Query Scope Summary
Selected Ontology
MAPOPT
Selected Topics
"PackPermeability", "MapOptTopic", "MapOpt_demo"
Selected Relations
CO2 Permeability_Relation
Please note : removing query scope leads to removing all query definition entries including preferences and global parameters.
remove query scope

Define domain values for attribute CO2 Permeability

Define numeric value domain

Select unit

Mole per Meter per second per pascal



best values

min	max
3e-15	5e-15

min	max
1e-15	7e-15

acceptable values

Are values... mandatory ? ○ desirable ? ○

save Cancel

QUERY: RESULTS

Query Results (2)

Ontology: MAPOPT - Topics: PackPermeability , MapOptTopic , MapOpt_demo
Relation: CO2 Permeability_Relation

■Mandatory □Desirable

rank	reliability score	CO2 Permeability [1.000e-15 ; 3.000e-15 ; 5.000e-15;7.000e-15] , mol/m/s/Pa	Temperature	Thickness	Relative Humidity	Partial pressure difference	Packaging
row 1_2607							
1		[1.840e-15] , mol/m/s/Pa	[2.000e+01] , °C	[6.950e+01 ; 7.750e+01] , µm	[7.000e+01] , %	[1.000e+02] , %	[Wheat gluten/paper]
row 5_160							
2		[1.026e-15] , mol/m/s/Pa	[4.500e+01] , °C	[7.700e+01 ; 8.300e+01] , µm	[5.000e+01] , %	-	[Proteins]

RELIABILITY/FIABILITE

Document's criteria values

Criterion repetition

Experience Repetition : yes

Criterion number of repetitions

Number of repetitions : unknown

Criterion age and citation number

Citation Number : more than 40

Age : more than 8 years old

Criterion age and top citation

Reliability evaluation's document information

Reliability results

Low expectation : 4.87 ; High expectation : 5.0

Known criteria values rate : 60 %

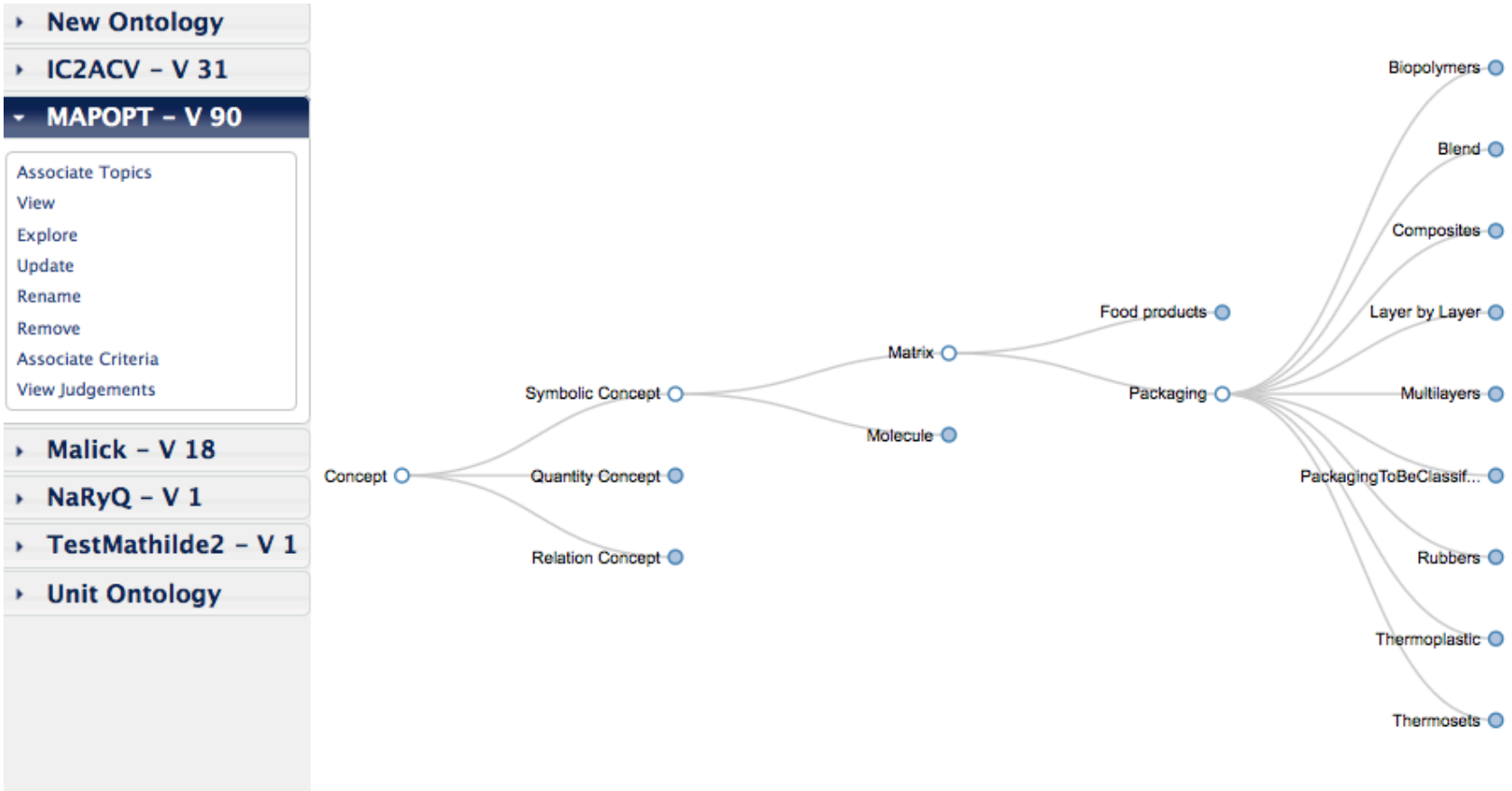
Last evaluation date : 2014-11-17

@Web - un retour sur utilisation

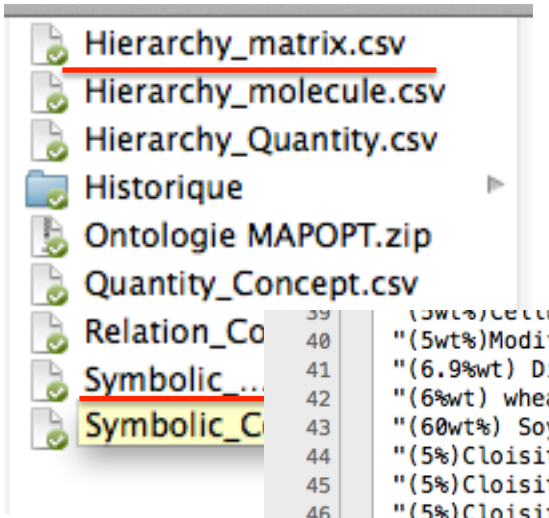
- Utilisateur confirmé → un article 1 à 2 h
  - En pratique: capitalisation d'un article / semaine
  - Mobilisation de l'équipe entière/pHD et post-docs
  - Réseau?
  - Possibilité d'importer directement les bases de données excel existantes?
- Query //5 à 10 min
  - Construction (3 étapes) +interrogation (30' à 1 min) + export des données si besoin

@Web - un retour sur utilisation

- Utilisateur confirmé → un article 1 à 2 h

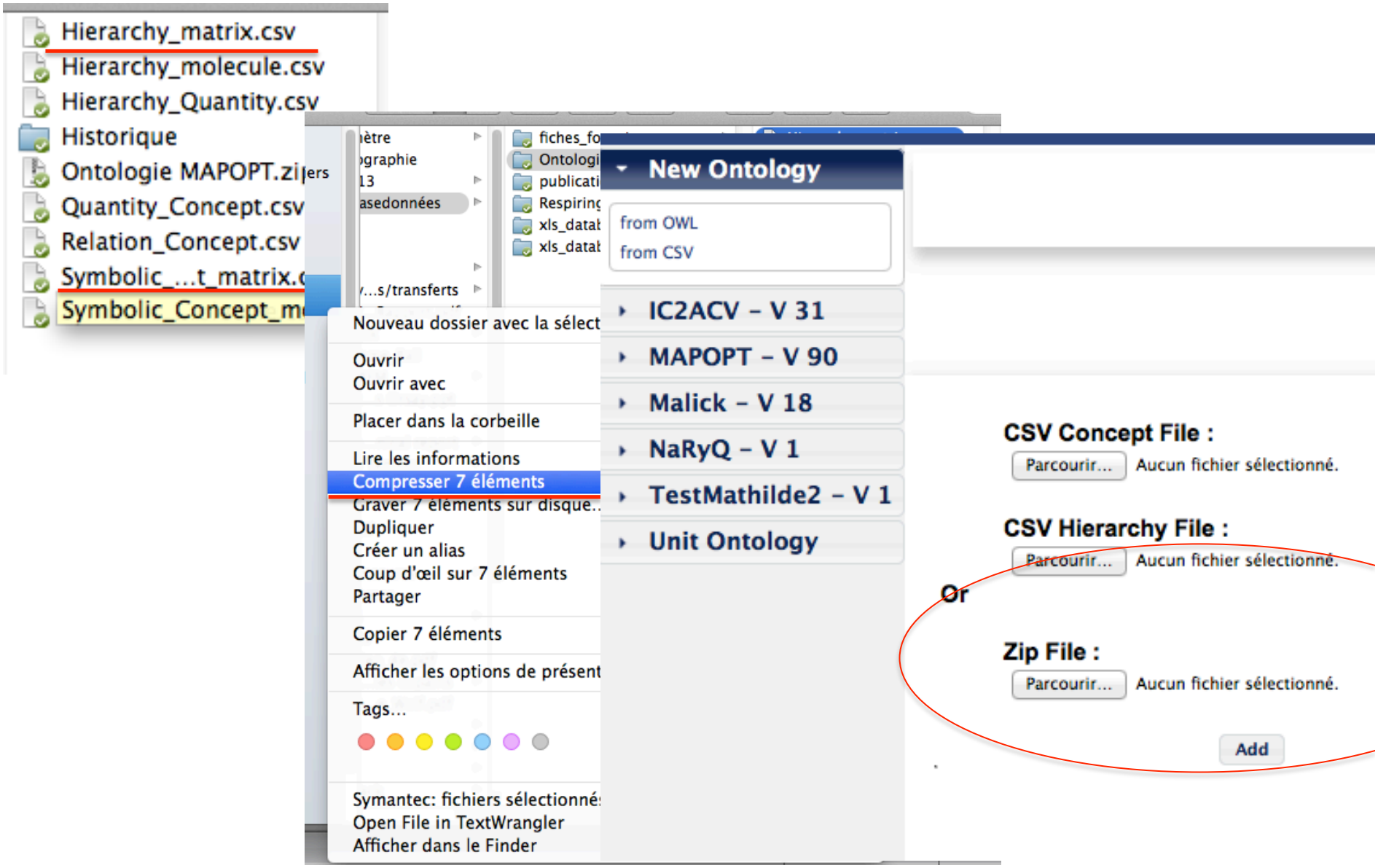


Modification de l'ontologie

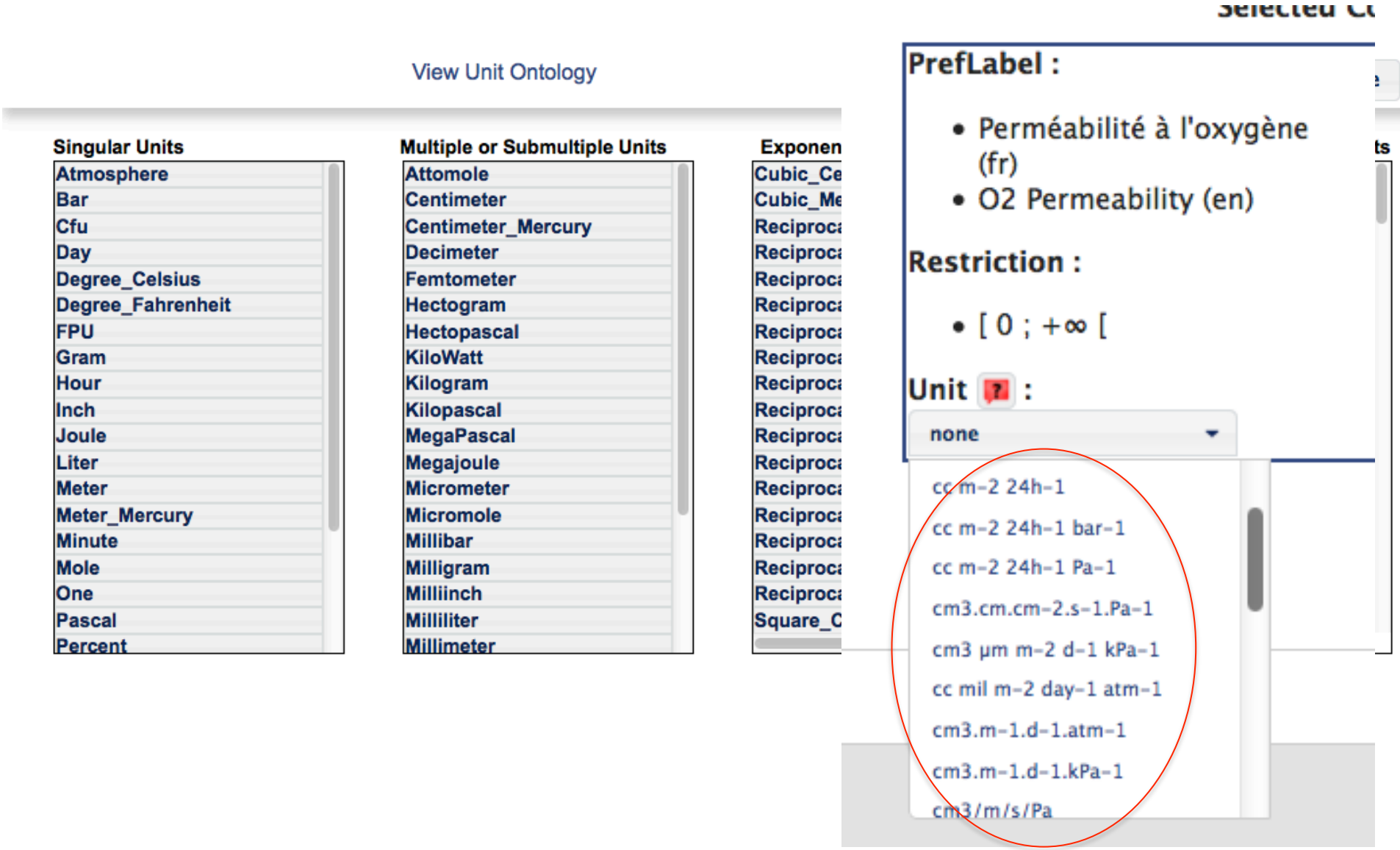



```
40  "(5wt%)Modified cellulose nanocrystals/(1wt%)Ag/Polylactic Acid";"(5wt%)s-CNC/(1wt%)Ag/PLA";;;;
41  "(6.9%wt) Dimethylbis(hydrogenated-tallow) ammonium montmorillonite (13.1wt%) Maleic anhydride grafted polye
42  "(6%wt) wheat straw fibers/Poly(3-hydroxybutyrate-co-3-hydroxyvalerate)";"(6%wt) wheat straw fibers/PHBV";;;
43  "(60wt%) Soy protein isolate/ (40wt%) Polylactic Acid";;;;;
44  "(5%)Cloisite Na+/Polylactic Acid";;;;;
45  "(5%)Cloisite 30B/Polylactic Acid";;;;;
46  "(5%)Cloisite 20A/Polylactic Acid";;;;;
47  "(1wt%)Cloisite 30B/PLA(4060D)";;;;;
48  "(1wt%)Cloisite 30B/PLA(4032D)";;;;;
49  "(2wt%)Cloisite 30B/PLA(4060D)";;;;;
50  "(2wt%)Cloisite 30B/PLA(4032D)";;;;;
51  "(3wt%)Cloisite 30B/PLA(4060D)";;;;;
52  "(3wt%)Cloisite 30B/PLA(4032D)";;;;;
53  "(4wt%)Cloisite 30B/PLA(4060D)";;;;;
54  "(4wt%)Cloisite 30B/PLA(4032D)";;;;;
55  "(5wt%)Cloisite 30B/PLA(4060D)";;;;;
56  "(5wt%)Cloisite 30B/PLA(4032D)";;;;;
57  "(6wt%)Cloisite 30B/PLA(4060D)";;;;;
58  "(6wt%)Cloisite 30B/PLA(4032D)";;;;;
59  "(Chitosan/Lambda-Carrageenan)20_Poly(ethylene terephthalate)";;;;;
60  "(Chitosan/Lambda-Carrageenan/Chitosan/Sodium Montmorillonite)10_Poly(ethylene terephthalate)";;;;;
61  "(Chitosan/Sodium Montmorillonite/Lambda-Carrageenan)10_Poly(ethylene terephthalate)";;;;;
62  "(Oriented polyamide)/adhesive/polypropylene copolymer";;;;;
63  "(Polyacrylamide/Sodium Montmorillonite)10- Polyethylene terephthalate";;;;;
64  "(Polyacrylamide/Sodium Montmorillonite)15- Pde)20- Polyethylene terephthalate";;;;;
65  "(Polyacrylamide/Sodium Montmorillonite)25- Polyethylene terephthalate";;;;;
66  "(Polyacrylamide/Sodium Montmorillonite)30- Polyethylene terephthalate";;;;;
67  "(Polyacrylamide/Sodium Montmorillonite)5- Polyethylene terephthalate";;;;;
68  "(Polyetylenimine pH7/Montmorillonite)40- Polyethylene terephthalate";;;;;
```

Modification de l'ontologie



Unités


View Unit Ontology
Singular Units
Atmosphere
Bar
Cfu
Day
Degree_Celsius
Degree_Fahrenheit
FPU
Gram
Hour
Inch
Joule
Liter
Meter
Meter_Mercury
Minute
Mole
One
Pascal
Percent
Multiple or Submultiple Units
Attomole
Centimeter
Centimeter_Mercury
Decimeter
Femtometer
Hectogram
Hectopascal
KiloWatt
Kilogram
Kilopascal
MegaPascal
Megajoule
Micrometer
Micromole
Millibar
Milligram
Milliinch
Milliliter
Millimeter
Exponen
Cubic_Ce
Cubic_Me
Reciproca
PrefLabel :
Perméabilité à l'oxygène (fr)
O2 Permeability (en)
Restriction :
[0 ; +∞ [
Unit :
none
cc m-2 24h-1
cc m-2 24h-1 bar-1
cc m-2 24h-1 Pa-1
cm3.cm.cm-2.s-1.Pa-1
cm3 µm m-2 d-1 kPa-1
cc mil m-2 day-1 atm-1
cm3.m-1.d-1.atm-1
cm3.m-1.d-1.kPa-1
cm3/m/s/Pa

Annotations

Manual Annotation of Table 1. Oxygen Transmission Data for 40-Bilayer Assemblies Made with Clay and PEI at Varying pH Levels

Original table

permeability (× 10 $^{-6}$ cc/(m·day·atm))					
40-BL assembly	OTR (cc/(m·day·atm))	film thickness (nm)	film [a]	total	Cussler's α predictions [b]
PEI $_7$ /MMT	8.42	48.02	48.55	1507.36	

Manual Annotation of Table 2. Central Composite Design Arrangement and Responses

Original table

Annotated table

n°	O2 Permeability Unit : mol/m/s/Pa	Partial pressure difference Unit : %	Packaging	Relative_Humidity Unit : %	Temperature Unit : °C	Thickness Unit : µm
1	1.110e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	1.460e+1	9.000e+0	[7.700e+1 ; 8.300e+1]
2	1.310e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	1.460e+1	3.900e+1	[7.700e+1 ; 8.300e+1]
3	1.011e-15	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	8.530e+1	9.000e+0	[7.700e+1 ; 8.300e+1]
4	8.630e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	8.530e+1	3.900e+1	[7.700e+1 ; 8.300e+1]
5	1.810e-16	[0.000e+0 ; 1.000e+2]	Wheat gluten (20% glycerol - casting)	5.000e+1	3.000e+0	[7.700e+1 ; 8.300e+1]

@Web - un retour sur utilisation

- Pouvoir ajouter un nom de concept directement lors de la saisie // sans intervenir sur les fichiers .csv
- Automatiser l'import de tableau excel
- Automatiser l'import de tableau html?
- Comment faire vivre l'outil?
  - Au delà des développements méthodo
  - Quel communauté? (académique uniquement?)
  - Quel support?